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Report of D. Cotten

The program of investigation of propagation phenomena in interplanetary space continues. The phenomena under study include the anisotropy of the BeV-energy nucleonic component of the cosmic radiation. This manifests itself as a diurnal variation and an apparent sidereal diurnal variation in the counting rates of cosmic ray neutron monitors. The amplitudes and phases of these variations are being examined as a function of time and location in the geomagnetic field, and are being considered theoretically. An additional phenomenon now under study is the propagation of extremely low frequency waves, principally in interplanetary space, and the excitation of these waves.

1. Theories of signal modulation and detection were examined in an attempt to identify the cause of an apparent anti-sidereal diurnal variation in the cosmic radiation. Over most of the period studied, 1957 to 1964, there is a definite indication of a sidereal diurnal variation, observed superposed on the solar diurnal variation in cosmic radiation. For a half-year, however, the phase and amplitude of the solar diurnal variation vary in such a sense as to indicate an anti-sidereal diurnal variation, in apparent contradiction to the several years of record which indicate the existence of a true sidereal diurnal variation. This does not appear to be simply noise in the variation. We are however, now including Mt. Norikura, a station with relatively high geomagnetic cutoff rigidity, in order to improve the signal to noise ratio.

Some gaps exist in the record of data which we have analysed, because of the unavailability of these data from the world data center A. The smoothing process described in previous program reports overcomes this deficiency to some extent, but we are still attempting to get complete continuous data for several stations, up to the present.

2. Further calculations have been made of the statistical reliability of the analysed differences in the amplitudes of the cosmic ray diurnal variation at various stations and for various time intervals. These reliability calculations employ the F test, so as to be useful for the comparison of two or several average amplitudes. The significance level is found to be well over 90%, often over 99%. A procedure has also been devised whereby the F-test gives an indication of the statistical significance of curves fitted to cosmic ray diurnal variation average amplitude by simple connection of points.

3. An additional graduate student, doctoral candidate B. Boller, has resumed examination of the excitation of hydromagnetic waves in the vicinity of the earth, and their propagation through interplanetary space. In particular, the appropriate dispersion relations were studied and numerically evaluated, in order to determine which of those frequencies expected to be excited can be expected to propagate with detectable amplitude.

Items 3, 4, and 5, are currently being prepared for publication, while items 1, 2, and 6 will similarly be written up upon completion.

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